

## TITLE OF THE INVENTION

## RECIPROCATING COMPRESSOR

## 5 CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 2003-85737, filed November 28, 2003 in the Korean Intellectual Property Office, the disclosure of which is  
10 incorporated herein by reference.

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

15 The present invention relates, in general, to reciprocating compressors and, more particularly, to a reciprocating compressor, which is provided with a connecting rod to connect a rotating shaft to a piston.

## 20 2. Description of the Related Art

Generally, a reciprocating compressor is a machine that compresses a refrigerant in a hermetic space, prior to discharging the refrigerant to an outside of the compressor. The reciprocating compressor includes a hermetic casing. A  
25 compressing unit to compress the refrigerant, and a drive unit to drive the compressing unit are installed in the hermetic

casing.

The compressing unit includes a cylinder block, a cylinder head, and a piston. The cylinder block defines a compression chamber to compress the refrigerant. The cylinder head is  
5 mounted to an end of the cylinder block, and includes a suction chamber to guide the refrigerant into the compression chamber, and an exhaust chamber to guide the compressed refrigerant from the compression chamber to an outside of the hermetic casing. The piston rectilinearly reciprocates in the compression  
10 chamber.

The drive unit includes a stator, a rotor, and a rotating shaft. When an electric power is applied to the stator, the stator generates an electromagnetic field. The rotor is rotated by the electromagnetic field generated along the  
15 stator. The rotating shaft is axially press-fitted into a center of the rotor to integrally rotate along with the rotor. Further, an eccentric shaft is integrally provided on a predetermined portion of the rotating shaft, and eccentrically rotates. A connecting rod is provided between the eccentric  
20 shaft and the piston to convert an eccentric rotating motion of the eccentric shaft into a reciprocating motion, thus reciprocating the piston.

An eccentric shaft mounting hole is provided on a predetermined portion of the connecting rod to allow the  
25 eccentric shaft to pass through the connecting rod. The

eccentric shaft mounting hole is larger than an outer diameter of the eccentric shaft, thus allowing the eccentric shaft to be easily mounted in the eccentric shaft mounting hole. After the eccentric shaft is mounted in the eccentric shaft mounting hole of the connecting rod, a bush is fitted into a space between the eccentric shaft and the eccentric shaft mounting hole to fill the space, thus allowing an eccentric rotating force of the eccentric shaft to be stably transmitted to the connecting rod.

However, in the conventional reciprocating compressor, the bush is press-fitted into the eccentric shaft mounting hole of the connecting rod. Thus, the conventional reciprocating compressor has a problem in that a force acts on the bush while press-fitting the bush into the eccentric shaft mounting hole, so that the bush may be compressed in a radial direction thereof, and friction may occur between compressed parts of the bush and the eccentric shaft, thus hindering the rotation of the eccentric shaft.

## SUMMARY OF THE INVENTION

Accordingly, it is an aspect of the present invention to provide a reciprocating compressor, which is capable of preventing a bush from being deformed while the bush is press-fitted into an eccentric shaft mounting hole of a connecting

rod.

Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned  
5 by practice of the invention.

The above and/or other aspects are achieved by a reciprocating compressor, including a rotating shaft, an eccentric shaft, a piston, a connecting rod, a bush, a fitting recess, and a fitting projection. The rotating shaft is  
10 rotated by a drive unit which generates a rotating force. The eccentric shaft is eccentrically rotated by the rotating shaft. The piston reciprocates by a force transmitted from the eccentric shaft, thus compressing a refrigerant. The connecting rod has, on an end thereof, an eccentric shaft  
15 mounting hole so that the eccentric shaft is mounted to the end of the connecting rod, and the connecting rod converts a rotating motion of the eccentric shaft into a reciprocating motion to reciprocate the piston. The bush is placed between the eccentric shaft mounting hole and the eccentric shaft to  
20 fill a space between the eccentric shaft mounting hole and the eccentric shaft, with a hinge hole being provided at a predetermined portion of the bush to allow the eccentric shaft to be rotatably fitted into the hinge hole. The fitting recess is provided on one of the eccentric shaft mounting hole and the  
25 bush. The fitting projection is provided on a remaining one of

the eccentric shaft mounting hole and the bush to correspond to the fitting recess, and the fitting projection engages with the fitting recess through a press-fitting process.

According to an aspect of the invention, the bush and the  
5 eccentric shaft mounting hole may be provided so that an outer diameter of the bush and an inner diameter of the eccentric shaft mounting hole are determined to provide a sliding allowance, thus allowing the bush to slide in the eccentric shaft mounting hole. The fitting projection and the fitting  
10 recess may be provided so that sizes of the fitting projection and the fitting recess are determined to provide a fitting allowance, thus allowing the fitting projection to be press-fitted into the fitting recess, and allowing the bush to be press-fitted into the eccentric shaft mounting hole through an  
15 engagement of the fitting projection with the fitting recess.

In another aspect of this embodiment, the fitting projection and the fitting recess may be provided so that an end surface of the fitting projection and an inner end surface of the fitting recess are determined to provide the sliding  
20 allowance, and both side surfaces of the fitting projection and both inner side surfaces of the fitting recess are determined to provide the fitting allowance.

In yet another aspect of this embodiment, the fitting recess may include a plurality of fitting recesses provided  
25 around the bush or the eccentric shaft mounting hole at regular

intervals, and the fitting projection may include a plurality of fitting projections provided around the remaining one of the bush and the eccentric shaft mounting hole at regular intervals.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiments, taken in  
10 conjunction with the accompanying drawings of which:

FIG. 1 is a sectional view of a reciprocating compressor, according to an embodiment of the present invention;

FIG. 2 is a perspective view of a connecting rod and a  
15 bush included in the reciprocating compressor of FIG. 1; and

FIG. 3 is a perspective view of a connecting rod and a bush of a reciprocating compressor, according to another embodiment of the present invention.

#### 20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein  
25 like reference numerals refer to like elements throughout. The

embodiments are described below in order to explain the present invention by referring to the figures.

As shown in FIG. 1, a reciprocating compressor according to the present invention includes a hermetic casing 10 to  
5 define an external appearance of the reciprocating compressor, with a drive unit 20 and a compressing unit 3 being installed in the hermetic casing 10. The drive unit 20 generates a power, and the compressing unit 30 compresses a refrigerant using the power of the drive unit 20.

10 The compressing unit 30 includes a cylinder block 31, a piston 32, and a cylinder head 33. The cylinder block 31 defines a compression chamber 31a therein. The piston 32 is received in the compression chamber 31a, and reciprocates in the compression chamber 31a to draw, compress, and discharge  
15 the refrigerant. The cylinder head 33 is mounted to an end of the compression chamber 31a, and includes a suction chamber 33a to guide the refrigerant into the compression chamber 31a, and an exhaust chamber 33b to guide the refrigerant from the compression chamber 31a to an outside of the hermetic casing  
20 10. A valve plate 34 is interposed between the cylinder block 31 and the cylinder head 33 to draw or discharge the refrigerant into or from the compression chamber 31a, according to a pressure of the compression chamber 31a.

The drive unit 20 includes a stator 21 installed in the  
25 hermetic casing 10. A rotor 22 is set in the stator 21, and is

rotated by an electromagnetic field generated along the stator 21 when an electric power is applied to the stator 21, thus generating a rotating force. A rotating shaft 23 penetrates the cylinder block 31 to transmit the rotating force from the rotor 22 to the compressing unit 30. An eccentric shaft 24 is provided on an end of the rotating shaft 23 to be eccentric from a central axis of the rotating shaft 23. The drive unit 20 also includes a connecting rod 25. The connecting rod 25 is rotatably mounted, at a first end thereof, to the eccentric shaft 24, and is hinged, at a second end thereof, to the piston 32. Thus, the connecting rod 25 converts a rotating motion of the eccentric shaft 24 into a rectilinear reciprocating motion to reciprocate the piston 32.

As shown in FIG. 2, according to an embodiment of the present invention, an eccentric shaft mounting hole 25a and a piston mounting hole 25b are respectively provided on opposite ends of the connecting rod 25 so that the eccentric shaft 24 and the piston 32 are respectively mounted to the opposite ends of the connecting rod 25. In this case, the eccentric shaft mounting hole 25a is larger than the eccentric shaft 24 so that the eccentric shaft 24 is easily mounted in the eccentric shaft mounting hole 25a. After the eccentric shaft 24 is mounted in the eccentric shaft mounting hole 25a, a bush 26 is fitted into a space between the eccentric shaft 24 and the eccentric shaft mounting hole 25a. The bush 26 fills the space between an

inner circumferential surface of the eccentric shaft mounting hole 25a and an outer circumferential surface of the eccentric shaft 24, thus allowing a rotating force of the eccentric shaft 24 to be stably transmitted to the connecting rod 25.

5       The bush 26 of a cylindrical shape has a hinge hole 26a at a center thereof, so that the eccentric shaft 24 is rotatably fitted into the hinge hole 26a. In this case, the bush 26 is press-fitted into the eccentric shaft mounting hole 25a of the connecting rod 25.

10       In order to prevent the bush 26 from being compressed in a radial direction thereof by a force generated when the bush 26 is press-fitted into the eccentric shaft mounting hole 25a, an outer diameter of the bush 26 and an inner diameter of the eccentric shaft mounting hole 25a are determined to provide a  
15       sliding allowance, thus allowing the bush 26 to slide in the eccentric shaft mounting hole 25a. Fitting projections 26b are provided on one of the bush 26 and the eccentric shaft mounting hole 25a, while fitting recesses 25c are provided on a remaining one of the bush 26 and the eccentric shaft mounting  
20       hole 25a, so that the fitting projections 26b engage with the corresponding fitting recesses 25c through a press-fitting process. Thereby, most of force, generated when the bush 26 is press-fitted into the eccentric shaft mounting hole 25a of the connecting rod 25, acts on only the fitting projections 26b and  
25       the fitting recesses 25c.

According to an embodiment, a plurality of fitting projections 26b are provided on an outer circumferential surface of the bush 26 at regular intervals. Further, a plurality of fitting recesses 25c are provided on an inner circumferential surface of the eccentric shaft mounting hole 25a, at regular intervals, to correspond to the plurality of fitting projections 26b, so that the fitting projections 26b engage with the fitting recesses 25c through the press-fitting process. In this case, the fitting projections 26b and the fitting recesses 25c are provided so that sizes of the fitting projections 26b and the fitting recesses 25c are determined to provide a fitting allowance, thus allowing the fitting projections 26b to be press-fitted into the fitting recesses 25c.

Further, an end surface of each of the fitting projections 26b is provided to correspond to an inner end surface of each of the fitting recesses 25c. Both side surfaces of each of the fitting projections 26b are provided to correspond to both inner side surfaces of each of the fitting recesses 25c. In this case, the end surface of each of the fitting projections 26b and the inner end surface of each of the fitting recesses 25c are determined to provide the sliding allowance. The both side surfaces of each of the fitting projections 26b and the both inner side surfaces of each of the fitting recesses 25c are determined to provide the fitting allowance. Thus, most of

the force generated when the bush 26 is press-fitted acts on the both side surfaces of the fitting projections 26b and the both inner side surfaces of the fitting recesses 25c.

According to an embodiment, the fitting projections 26b  
5 are provided on the bush 26, while the fitting recesses 25c are provided on the eccentric shaft mounting hole 25a. However, as shown in FIG. 3, fitting recesses 26b' may be provided on the bush 26, while fitting projections 25c' may be provided on the eccentric shaft mounting hole 25a.

10 The assembly process and operational effect of the connecting rod of the reciprocating compressor according to the present invention will be described in the following.

First, the piston 32 is hinged to the piston mounting hole 25b of the connecting rod 25, and then is inserted into the  
15 compression chamber 31a provided on the cylinder block 31. Subsequently, the rotating shaft 23 is installed to penetrate the cylinder block 31, and the eccentric shaft 24 provided on an end of the rotating shaft 23 is installed in the eccentric shaft mounting hole 25a. In this case, the inner diameter of  
20 the eccentric shaft mounting hole 25a is sufficiently larger than the outer diameter of the eccentric shaft 24, thus allowing the eccentric shaft 24 to be easily installed in the eccentric shaft mounting hole 25a.

In such a state, the bush 26 is press-fitted into the  
25 eccentric shaft mounting hole 25a. The eccentric shaft 24 is

rotatably installed in the hinge hole 26a of the bush 26, and the space between the eccentric shaft 24 and the inner circumferential surface of the eccentric shaft mounting hole 25a is filled with the bush 26. Thereby, the eccentric  
5 rotating motion of the eccentric shaft 24 is stably converted into the reciprocating motion to reciprocate the piston 32.

In this case, the bush 26 is provided to have the sliding allowance relative to the inner circumferential surface of the eccentric shaft mounting hole 25a, so that the bush 26 is  
10 press-fitted into the eccentric shaft mounting hole 25a through engagement of the fitting recesses 25c and the fitting projections 26b. Further, the both side surfaces of each of the fitting projections 26b and the both inner side surfaces of each of the fitting recesses 25c are determined to provide the  
15 fitting allowance, so that only the both side surfaces of each of the fitting projections 26b are press-fitted into the both inner side surfaces of each of the fitting recesses 25c. Thereby, most of the force, acting on the fitting projections 26b when the bush 26 is press-fitted into the eccentric shaft  
20 mounting hole 25a, acts on the both side surfaces of each of the fitting projections 26b in a circumferential direction. Thus, the force which acts on the fitting projections 26b is offset, and the bush 26 is prevented from being compressed in a radial direction of the bush 26.

25 As is apparent from the above description, the present

invention provides a reciprocating compressor, which is constructed so that a bush provided between an eccentric shaft and a connecting rod is press-fitted into an eccentric shaft mounting hole of the connecting rod through engagement of both  
5 inner side surfaces of a fitting recess with both side surfaces of a fitting projection, thus causing force generated when the bush is press-fitted to act in a circumferential direction and thereby being offset, therefore preventing a bush from being compressed in a radial direction thereof.

10        Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and  
15 their equivalents.